Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army										DATE: February 2012	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 7: *Operational Systems Development*				R-1 ITEM NOMENCLATURE PE 0708045A: *End Item Industrial Preparedness Activities*							
COST ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**Cost To Complete**	**Total Cost**
Total Program Element	56.816	59.297	59.908	-	59.908	59.952	65.150	64.550	66.183	Continuing	Continuing
E25: *MFG SCIENCE & TECH*	56.816	59.297	59.908	-	59.908	59.952	65.150	64.550	66.183	Continuing	Continuing

Note

Program reduced due to reduction in Army TOA.

A. Mission Description and Budget Item Justification

This program element (PE) develops and demonstrates manufacturing processes that enable improvements in producibility and affordability of emerging and enabling components and subsystems of Army air, ground, Soldier, and command/control/communications systems. Initiatives within the PE result in cost savings and reduced risk of transitioning military-unique manufacturing processes into production. Project E25 fosters the transfer of new/improved manufacturing technologies to the industrial base, including manufacturing efforts that have potential for high payoff across the spectrum of Army systems.

Work in this PE is related to, and fully coordinated with, PE 0603710A (Night Vision Advanced Technology), PE 0602303A (Missile Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0602705A (Electronics and Electronic Devices).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

Work in this PE is performed by the Army Research, Development, and Engineering Command (RDECOM) and efforts are executed by the Army Research Laboratory (ARL) and appropriate Army Research, Development, and Engineering Centers (RDECs).

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B. Program Change Summary ($ in Millions)	**FY 2011**	**FY 2012**	**FY 2013 Base**	**FY 2013 OCO**	**FY 2013 Total**
Previous President's Budget	61.098	59.297	70.390	-	70.390
Current President's Budget	56.816	59.297	59.908	-	59.908
Total Adjustments	-4.282	-	-10.482	-	-10.482
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.282	-			
• Adjustments to Budget Years	-	-	-10.482	-	-10.482

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COST ($ in Millions)	FY 2011	FY 2012	FY 2013 Base	FY 2013 OCO	FY 2013 Total	FY 2014	FY 2015	FY 2016	FY 2017	Cost To Complete	Total Cost
E25: *MFG SCIENCE & TECH*	56.816	59.297	59.908	-	59.908	59.952	65.150	64.550	66.183	Continuing	Continuing
Quantity of RDT&E Articles											

A. Mission Description and Budget Item Justification

This project develops and demonstrates manufacturing processes that enable improvements in producibility and affordability of emerging and enabling components and subsystems of Army air, ground, Soldier and command/control/communications systems. Focus is on components and subsystems such as advanced armor, power and energy devices, rotors, sensors, displays, propellants and gun tubes. In addition, work is conducted to advance the state of the art in processing and fabrication techniques for coatings, multifunctional materials and structural elements for Army specific applications.

Work supports all Army S&T portfolios. Work in this PE is related to and fully coordinated with PE 0602105A (Materials Technology), PE 0602211A (Aviation Technology, PE 0602303A (Missile Technology), PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Ballistics Technology), PE 0602705A (Electronics and Electronic Devices). PE 0603003 (Aviation Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0603710A (Night Vision Advanced Technology).

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this project is performed by the Army Research, Development, and Engineering Command (RDECOM) and efforts are executed by the Army Research Laboratory (ARL) and appropriate Army Research, Development, and Engineering Centers (RDECs).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
Title: Air Systems	10.110	11.963	13.112
Articles:	0	0	
Description: This effort funds manufacturing technology advances needed for more affordable manned and unmanned aircraft components and subsystems. Work focuses on addressing challenges in areas such as engine performance and life, rotor and blade durability, reliable component integration/attachment, structural durability at low weight, and reduced corrosion.			
FY 2011 Accomplishments: Automation of Blade Erosion Coating: Increased manufacturing yield and efficiency of anti-corrosion spray coating processes that increased blade life and quality over current manual coating processes. Advanced Ceramic Manufacturing and Machining: Evaluated high yield manufacturing processes enabling application of new Ceramic Matrix Composite technologies that significantly improved thrust, fuel consumption, and reliability compared to current T-700 helicopter engine. Validated low cost manufacturing solutions for structural components and transitioned to program of record. Manufacturing Technology			

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
for Affordable & Reliable UAV Propulsion: identified innovative manufacturing processes to address common engine issues. KIOWA Portable Alignment System (KPAS): demonstrated higher accuracy alignment devices to assist field maintenance and manufacturing processes associated with replacement components on helicopters to include the Kiowa. CH 47 Out of Auto Clave Tunnel Cover: demonstrated new composites manufacturing methods on CH-47 tunnel covers that are lower cost, lighter weight and have improved impact and durability performance than current aluminum honeycomb components. ***FY 2012 Plans:*** Apply erosion coating materials onto UH-60 and AH-64 rotor-blades which will decrease the number of blades repaired from 48 to 24 a year and reduce coating costs from $18K - $14K per rotor-blade. Develop novel tooling approaches and manufacturing processes to increase UAV heavy fuel engine performance, fuel efficiency and reliability, which reduces overall UAV life cycle costs. Integrate improved heavy fuel engine manufacturing processes into UAV platforms to demonstrate effectiveness. Develop cost effective processes for manufacturing nano-composite coatings which increases performance, durability and reliability of UH-60 and AH-64 components. Automate nano-composite application processes and equipment to reduce coating costs. Manufacture high performance flexible airborne antennas substrates using both chemical and riveting techniques. Improve auto clave, bonding lines and joints to increase yield rates which reduce antenna manufacturing costs. Demonstrate improved cost effective Environmental Barrier Coating (EBC) deposition methods and combine materials, process improvements to reduce fabrication labor and weight for T-700 helicopter engine shrouds. ***FY 2013 Plans:*** Will demonstrate an advanced ceramic manufacturing process for the fabrication of Ceramic Matrix Composite (CMC) and Stage High Pressure Turbine (HPT) Shrouds for helicopter engines to reduce overall system weight and improve fuel consumption and reliability; develop manufacturing processes for the use of direct metal laser sintering to reduce cost and increase performance of complex components such as UAV turbine engine recuperators; demonstrate machining of rotary engine side seal grooves which will increase the reliability and performance of rotary engines for UAV applications; demonstrate a chemical etching technique for high performance flexible airborne antenna substrates by using lay-up processes to reduce touch labor and riveting issues resulting in significantly increased yield and reduced cost per missile; and develop and demonstrate automated Plasma Assisted Chemical Vapor Deposition equipment and manufacturing procedures for the application of nanocrystalline diamond and amorphous carbon coatings for improved optical transmission for infrared devices, improved corrosion resistance, increased surface hardness, reduced friction, and increased wear performance on critical AH-64 and UH-60 helicopter components.			
Title: Base Structural Armor ***Articles:*** ***Description:*** Base Structural Armor consists of advanced armor systems for vehicles, to include ceramics, monolithic metal solutions and hybrid armor solutions. Future efforts in this area are moved to the Ground Systems Domain.	9.887 0	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2013 Army		DATE: February 2012
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
FY 2011 Accomplishments: Demonstrated and qualified ballistic and blast armors, add on protective modules and limited production of build-to-print armor with automated specification controls. Demonstrated low yield automated assembly of ceramic composites suitable for the fabrication of Ballistic, Hull & Turret, and high yield production of affordable Silicon Carbide (SiC) and Titanium (Ti). Showed production yield for ballistic and blast armors suitable for combat vehicles and add on protective modules with scalable protection requirements. Showed suitable base and add-on armor production facilities and began transition of production protocols to Ground Combat Vehicle and other platform programs of record with these ballistic requirements.			
Title: Ground Systems	4.321	6.563	9.945
Articles:	0	0	
Description: This effort funds manufacturing technology advances needed for more affordable components and subsystems for tactical and combat vehicles and weapons systems. Work focuses on addressing challenges in areas such as advanced armor, gun barrel life, insensitive propellants, precision munitions and vehicle power devices. ***FY 2011 Accomplishments:*** Low Cost Sintered Spinel Transparent Armor Mfg Scale-Up & Protection: demonstrated manufacture processes of spinel armor plates in sizes up to 600 square inch which reduced cost and weight for tactical vehicles. Showed high yield fabrication capability for ceramic composites with reduced weight and improved ballistic protection. ***FY 2012 Plans:*** Develop aluminum oxide manufacturing processes for sintered Spinel powder applications. Improve transparent armor production using a sintered technique which lowers the cost from $3k to $1.2k a square foot. Develop improved manufacturing processes and process controls to lower the cost, weight and material flaws for low rate production of combat vehicle modular armor. ***FY 2013 Plans:*** Will begin to scale-up manufacturing of high optical clarity Spinel armor plates up to 14? x 14? in size by using a sintered process to address both size and cost; develop low cost production and assembly processes of complex passive kinetic energy armors for combat vehicle systems; exploit forming/forging/joining technologies to enable fabrication of a single under-body design of high performance/strength alloys for a blast resistant lower hull and underbody kits for combat vehicle systems; develop explosive loading processes, requiring no post-machining, inside warhead molding of insensitive munitions and fragment generating sleeves for the EAPS and next generation cluster munitions; develop a manufacturing process to reduce the cost and time associated with applying Ta-10W liners for medium and large caliber Chromium free cannon barrels; and develop initial manufacturing processes for automated production of low cost, high power battery and fuel cell systems for manned and unmanned ground systems.			
Title: Command, Control and Communications Systems	11.080	18.994	20.465

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
Articles:	0	0	

Description: This effort funds manufacturing technology advances needed for more affordable components and subsystems for intelligence, surveillance, reconnaissance and targeting systems, mission command systems, electronic warfare, and Improved Explosive Device detect/defeat systems. Work focuses on addressing challenges in areas such as large format multi-color focal plane arrays, flexible displays, night vision sensors, target detectors, advanced antennas and sensors.

FY 2011 Accomplishments:
Chip-scale atomic clock: demonstrated vacuum environment manufacturing processes for components package including small rubidium atomic power sources, transducers, electronic circuits, and ballistic housings that support chip scale atomic clock deployment concept. High definition multi-band focal plane array: demonstrated low volume production of array and wafer size of 80 square centimeters, and increased focal plane array substrate diameter and growth yield, improved growth yield. Low light level sensor: completed assembly and initial optimization of automated process station that will increase photo-response and manufacturing capability. Large affordable substrates: increased material growth and pixel fabrication processes to enable affordable large format, multi-color focal plane arrays for high definition infrared sensors that improve situational awareness and target detection. High operating temperature and multi-band focal plane arrays: initiated baseline lots, conducted tradeoffs and selected initial manufacturing process improvements for pilot line transition.

FY 2012 Plans:
Develop a production capacity for low cost, very large, affordable infrared (IR) focal plane arrays (FPA) using III-V epitaxial materials. Improve HgCdTe pilot lines by increasing the diameters of substrates and reduce material waste, decreasing costs for FPA production. Develop single-layer crystal yield and demonstrate improved polishing processes for more uniformed FPA substrates. Reduce propagate density and decrease surface roughness of FPA substrate and transition to PEO. Manufacture the final components package, demonstrate limited production of chip scale atomic clock power sources and begin transition to Air Force GPS Wing and PEO C3T. Develop full color organic light emitting diodes (OLEDS) from a fully integrated flexible display pilot production line for demonstrations to system integrators. Manufacture processing station for night vision sensor optimization to reduce costs and increase reliability from 1200 to 10000 hours per sensor.

FY 2013 Plans:
Will optimize the production of the Automated Exhaust Station (AES) to increase yield and demonstrate increased median photocathode response for improved low-light-level sensor performance; demonstrate lot-sized production of 200 and 325 sqcm focal plane array (FPA) wafers, improving yield and small pixel processing/hybridization; manufacture and evaluate sample batches of 640x480, 1920x1280 and 1280x720 pixel FPAs to validate improved yield for affordable high definition, multi-band, multi-color FPAs grown on low-cost substrates for target acquisition and vision systems; demonstrate lot-sized production of 49 sqcm wafers for high-operating temperature FPAs, reducing surface defects and improving contrast ratio for wide area coverage

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
of persistent surveillance systems; integrate OLEDS into the Gen II production line for 6.4-12 inch diagonal flexible displays to achieve a resolution of 600x800 super video graphics array (SVGA).			
Title: Low Cost Zinc Sulfide Missile Dome ***Articles:*** ***Description:*** Funding is provided for the following efforts. ***FY 2011 Accomplishments:*** Optimized post-deposition treatments and scale-up reactor production process for long range missile domes and transitioned to PM JAGM.	3.104 0	-	-
Title: Precision Munitions and Armament Systems ***Articles:*** ***Description:*** The Precision Munitions and Armament Systems focus area consists of Advanced Weapon Systems, Fire Control, Logistics, Emerging Technologies and Advanced Energetics and Warheads. Future efforts in this area are moved to the Ground Systems portfolio. ***FY 2011 Accomplishments:*** Developed automated processes for the assembly of the Grenade Initiation Module (GIM) that eliminated the manual processes and validates reliability of the automatic process. Demonstrated molybdenum fast jet manufacturing improvements and refined charge processes. Showed reduced cost production processes for solvent less propellant. Improved processing technology using modeling and simulation to enable the production of new generation insensitive munitions formulation. Installed equipment and demonstrated lower production cost (from $5.00/lb to $4.25/lb) and improved yield of key ingredients used in explosive formulations for 155mm artillery, 60 mm mortar and Spider munitions. Baselined the current honing process for gun barrels to decrease processing time for new materials to include tantalum-tungsten. Completed baseline analysis and initial test plan that establishes a new production capability for IMX-104 insensitive munition. Demonstrated new application of GaN processes to reduce cost in non-lethal weapons. ***FY 2012 Plans:*** Develop a manufacturing process for molding the frag-sleeve into a warhead body for decreased manufacturing time and cost. Develop field assisted spark technology and embedded tungsten fragment molding processes which will reduce production man-hours and lower cost. Develop processes for residence time, temperature, agitation rate and order of feeds to optimize IMX 104 manufacturing process and transition to PM-CAS. Manufacture a crown breach design using a hexavalent chromium free cladding process for large and medium caliber gun barrels. Develop a tantalum tungsten alloy protective bore coating to enable	8.781 0	9.975 0	6.568

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
higher performance ammunition. Demonstrate M-Charge liner improvements, billet fabrication and warhead case fabrication which reduces costs from $6K to $5K per warhead and increases yield to from 75% to 98%. ***FY 2013 Plans:*** Develop the manufacturing process to reduce the cost and time associated with applying Ta-10W liners for medium and large caliber Chromium free cannon barrels. Develop explosive loading processes, requiring no post-machining, inside warhead molding of insensitive munitions and fragment generating sleeves for the EAPS and Next Generation Cluster Munitions.			
Title: Laser Ignition ***Articles:*** ***Description:*** Funding is provided for the following efforts. ***FY 2011 Accomplishments:*** Completed transition of production specifications, methodology and brazing process controls. Demonstrated manufacturing protocols for compact crystal assembly and electronics to facilitate full scale production of modular assembly accessed at MRL 8.	1.125 0	-	-
Title: Flexible Display Technology ***Articles:*** ***Description:*** Future efforts in this area are moved to the Command, Control, and Communications Systems portfolio. ***FY 2011 Accomplishments:*** Demonstrated sensor manufacturing processes and demonstrated flexible electronics integrated with flexible displays for reduced sensor power and improved computational performance. ***FY 2012 Plans:*** Develop full color OLEDS from fully integrated GEN II pilot line for demonstrators to system integrators.	5.093 0	5.153 0	-
Title: Soldier Systems ***Articles:*** ***Description:*** This effort funds manufacturing technology advances needed for more affordable components and subsystems for combat feeding, aerial delivery of supplies, expeditionary basing, Soldier-borne sensors, clothing and protective equipment. Work focuses on addressing challenges in areas such as multifunctional fabrics for shelters, uniforms and portage equipment; affordable, non-contaminating packaging for rations; and lightweight materials for body armor. ***FY 2011 Accomplishments:***	2.689 0	3.482 0	3.966

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
Developed pilot processes and control systems to characterize manufacturing performance for conformal body armor utilizing new composite materials. Evaluated processes for non-woven materials and fabricated prototype systems to demonstrate lowered manufacturing cost and reduced energy consumption over existing tent materials. scaled up and demonstrated improved manufacturing processes of ration header technology that produces no hydrogen emissions, and enhances safety and ease of use by the Soldier. Identified improvements and began process trials on coating and laminate process for shelter fabrics. Investigated manufacturing improvements that would reduce cost and improve quality of CK used in chemical/biological defense systems. ***FY 2012 Plans:*** Develop manufacturing processes for nano-pigment and additives and will improve dispersion of the resins to increase performance and reliability of chemical/biological (CB) resistant shelters. Fabricate and demonstrate multiple 600 ft tent structures that meet joint expeditionary collective protection requirements. Develop new generation of scalable and affordable manufacturing processes for lightweight body armor. Demonstrate stacked tooling which reduces costs for bulk manufacturing of organic composite materials and co-curing processes for the X-SAPI body armor system. ***FY 2013 Plans:*** Will complete the manufacturing of T6 laminate at 14oz/yd2 for Low Rate Initial Production of shelter fabric; complete and demonstrate the low rate initial production (LRIP) process for lightweight x-SAPI plates for a flexible hybridized body armor solution; and demonstrate low-cost rapid prototyping and injection molding techniques for protective mask systems.			
Title: Advanced Manufacturing Initiatives	0.626	3.167	5.852
Articles:	0	0	
Description: This effort funds manufacturing technology advances needed for affordable model based manufacturing, network centric manufacturing data environments, collaborative manufacturing modeling and simulation, and advanced manufacturing technologies. Work focuses on addressing challenges in areas such as 3D technical data packages for armor systems; providing digital manufacturing capabilities to depots and laboratories, processes and models for data transfer and prototype production; and advanced laser manufacturing techniques for repairing components. ***FY 2011 Accomplishments:*** Identified key areas for a DOD-wide military standard for annotating technical data with manufacturing information in order to replace 2D drawings with 3D data packages during design, test, manufacturing and sustainment phases of a weapon system. ***FY 2012 Plans:***			

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2011	FY 2012	FY 2013
Develop fully annotated 3D digital technical data packages (TDP) for vehicle passive and protective armor systems that can be used in design and manufacturing production lines. Support the digital capabilities to depots and labs to facilitate integration, refit and rebuild operations. Develop advanced manufacturing environment. ***FY 2013 Plans:*** Will integrate depot planning and rebuild operations within a 3Dimensional TDP; establish interactive S1000D publications (International specification for technical publications utilizing a Common Source Database), manuals and work instructions; and identify Type 1 NSNs to link with the 3D TDPs; and develop processes and models for demonstrating data transfer and prototype production within a collaborative environment.			
Accomplishments/Planned Programs Subtotals	56.816	59.297	59.908

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

Not applicable for this item.

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.